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Flower Visitor Fauna of *Lespedeza* subgenus Macrolespedeza in Northern Japan

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Flower visitors to four species of *Lespedeza* subgenus Macrolespedeza were observed in northern Japan. The constant major flower visitors were apoid bees based on the analyses of their pollen loads in the fields. They were, therefore, considered to be important pollinators for Macrolespedeza. Relative frequency of *Bombus* was higher than those of any other flower visitors for all the Macrolespedeza plants examined except *Lespedeza buergeri*. The frequency of *Bombus* was higher than those of all previous reports on Macrolespedeza species from western Japan. In *L. buergeri*, no *Bombus* was observed but *Megachile* was the main visitor in the present studies. Length of claw and basal parts of laminae from the base to the reflected part of standards in *L. bicolor* in two populations tended to be longer than those of the previously known length. This fact may be related to the predominance of *Bombus* with the longest glossa of all apoid bees visiting Macrolespedeza plants.

Key words: Apoid bee, *Bombus*, flower morphology, flower visitor, Macrolespedeza.

Lespedeza subgenus Macrolespedeza (Leguminosae) comprises 11 species native to East Asia. The subgenus is distinguished from the other subgenus, subgen. Lespedeza, by the lack of cleistogamous flowers and having larger flowers (Ohashi 1982). These features suggest that the flowers need to be visited by insect pollinators for their sexual reproduction. These insects are assumed to play an important role for diversification of floral morphology in the species of *Lespedeza* subgenus Macrolespedeza (shortly the Macrolespedeza species in this paper). Our observations on the flower visitor fauna on Macrolespedeza in Korea (Yokoyama et al. 2000) indicated that *L. melanantha*, with a characteristic tubular corolla, is visited predominantly by *Bombus* spp. with relatively longer glossae than the other bees which are main flower visitors of the other

Macrorespedeza species in Korea. However, we need further records of the flower visitor fauna on Macrolespedeza species in order to analyze relationships between the flower structure and characteristics of the flower visitors. Here we report the results of the flower visitor fauna of Macrolespedeza species in northern Japan (mainly Tohoku and Hokkaido districts), which shows that the flower visitor fauna in northern Japan is considerably different from previous observations carried out mainly in the region from the Kanto district and westwards. In addition, we conducted preliminary investigations on floral traits of *L. bicolor*, the most widespread Macrolespedeza species in Japan, in order to consider the relationship between flower morphology and the flower visitor fauna.

Materials and Methods

Field observations were carried out in northern Japan from 1997 to 2003. We observed the following four species of *Lespedeza,* i. e., *L. bicolor* Turcz., *L. buergeri* Miq., *L. cyrtobotrya* Miq., and *L. homoloba* Nakai. Study sites, and the Macrolespedeza species observed are listed in Table 1. Geographic locations of the study sites are indicated in Fig. 1. We observed 1–3 individuals for each species for more than 20 minutes at each site and recorded all insect visitors to these plants. Among insects recorded, apoid bees (Superfamily Apoidea, Hymenoptera) were identified at a generic level and other insects at a family level. All voucher specimens of Macrolespedeza species are deposited in the Herbarium, Graduate School of Science, Tohoku University (TUS) and insect specimens are kept in the Department of Ecology and Evolutionary Biology, Graduate School of Life Sciences, Tohoku University.

To examine constancy of flower visitors to definite species, the proportion of pollen grains of Macrolespedeza to those of other plant groups in pollen loads were examined for the specimens of 101 individuals collected during field observations. Pollen grains were removed from their corbicula (Apidae) or scopa (other family) and suspended in 500 ml of 70 % ethanol for each specimen. We removed 25 ml from each suspended solution and counted pollen grains included in it under a light microscope. These pollen grains were also compared with those directly removed from flowers of Macrolespedeza species and classified into two categories, i. e., pollen grains of Macrolespedeza or those of other plants.

Measurements of flowers were conducted to investigate the relationship between flower morphology and the flower visitor fauna. As pointed out in a previous study (Yokoyama et al. 2000), the reflected part of the standard attracts particular interest from the viewpoint of pollination biology of Macrolespedeza because it guides a visiting bee to the nectary. When bees collect nectar from Macrolespedeza flowers, they first land on wings or keel-petals and put their heads at the reflected part of standards. Then they elongate their glossae to the adaxial base of androecia for collecting the nectar secreted from the intrastaminal disc (Nemoto and Ohashi 1988). Therefore, the length from the base to the reflected part of the standard (LR hereafter) is related to the length of the glossae of flower visitors. We measured LR of *L. bicolor* in the populations of Samani, Hidaka, Hokkaido (SMN) and Mt. Izumigatake, Sendai, Miyagi (IZM). Flowers were collected from the field and immediately fixed with 70 % ethanol. Thirty flowers (three flowers form each individual in ten individuals from each population) were measured for each population using a digital caliper and compared with the data of Akiyama (1988).

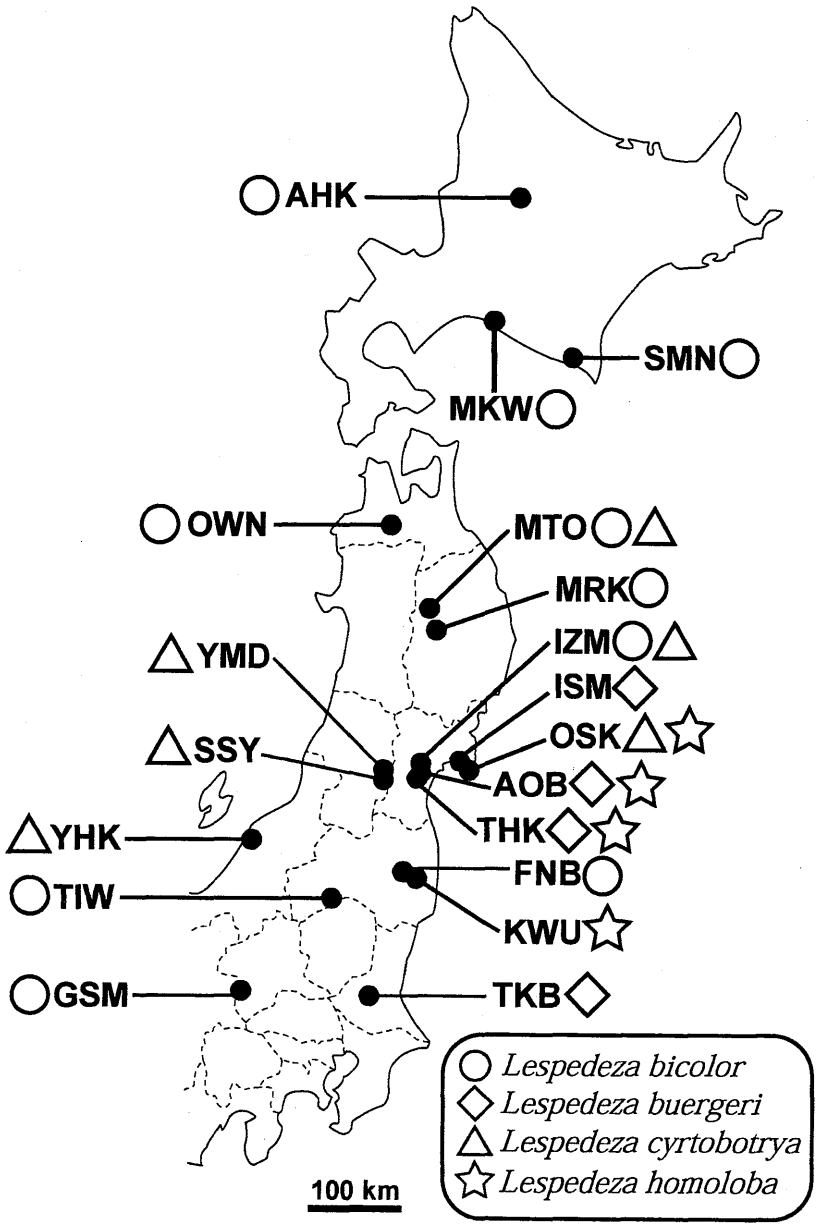

Fig. 1. Locations of the observation sites in the present study. Abbreviations of the sites correspond to those in Table 1.

Results

Flower visitors and their importance for pollination

Flower visitors observed on plants of the Macrolespedeza species are listed in Table 2. Apoid bees represented 73.2–100 % of the total visits (Fig. 2, A–E) in every study site except *Lespedeza cyrtobotrya* in OSK. All apoid bees have hundreds of pollen grains on their bodies (Fig. 2F). The pollen loads ex-

Table 1. *Lespedeza* species observed in the present study and their observation sites

Species	Observation site	Abbreviation	Date and duration (hrs.)
L. bicolor Turcz.	Hokkaido: Hidaka, Samani	SMN	1997. 8.22 (1); 1998.8.20 (4.5)
	Hokkaido: Iburi, Mukawa	MKW	1998.8.18 (0.5)
	Hokkaido: Kamikawa, Asahikawa	AHK	2003.9.7 (0.3)
	Aomori: Oowani, Mt. Ajara	OWN	1999.8.3 (0.3)
	Iwate: Matsuo, Maemori	MTO	1999.7.31, 8.2 (0.6)
	Iwate: Morioka, Teshiromori	MRK	1997.8.14 (0.5)
	Miyagi: Sendai, Mt. Izumigatake	IZM	1997.7.30, 8.19 (3); 1998.8.14, 8.20, 8.25, 9.5 (4.5)
	Fukushima: Funabiki, Kadosawa	FNB	2000.8.19 (0.3)
	Fukushima: Tateiwa, Nakayama Pass	TIW	2001.8.26 (0.3)
	Gunma: Shimonita, Minaminomaki	GSM	1999.8.7 (0.3)
L. buergeri Miq.	Miyagi: Ishinomaki, Tsukiura	ISM	1998.9.15 (0.3)
	Miyagi: Sendai, Aobadai	AOB	1997.7.1, 7.2, 8.21, 9.1 (5); 1998.9.9 (2); 2000.7.18, 7.27 (4)
	Miyagi: Sendai, Mt. Taihaku	THK	1998.9.12 (4); 2000.7.21 (2)
	Ibaraki: Tsukuba, Mt. Tsukuba	TKB	1998.9.11 (0.5)
L. cyrtobotrya Miq.	Iwate: Matsuo, Maemori	MTO	1999.8.2 (0.5)
	Miyagi: Oshika, Ohara	OSK	1997.9.28 (0.3)
	Miyagi: Sendai, Mt. Izumigatake	IZM	1998.9.12, 9.20 (1), 2000.9.2 (0.5)
	Yamagata: Yamagata, Yamadera	YMD	1997.8.28 (1)
	Yamagata: Yamagata, Sasaya Pass	SSY	1997.8.3, 8.18 (2), 1998.8.18, 8.22 (4.5)
	Niigata: Mt. Yahiko	YHK	1999.8.29 (0.3)
L. homoloba Nakai	Miyagi: Oshika, Ohara	OSK	1997.9.28 (0.3)
	Miyagi: Sendai, Aobadai	AOB	1997.9.10 (3), 1998.9.9 (3.5)
	Miyagi: Sendai, Mt. Taihaku	THK	1998.9.5, 9.12 (8)
	Fukushima: Kawauchi, Takatsuka	KWU	1998.9.12 (0.3)

amined of all but three samples of apoid bees contained more than 50 % of Macrolespedeza pollen grains. Average proportion ± SD of Macrolespedeza pollen in the loads was 82.6 ± 18.5 % (n = 101; Table 3). This fact suggests a high degree of flower constancy of the bees examined. In contrast, wasps (Scolidae and Eumenidae, Hymenoptera) and syrphid flies (Syrphidae, Diptera) visited Macrolespedeza species only in low frequencies (wasps: 2.2 % of total visits, syrphid flies: 0.5 %) and they were ineffective as pollinators because less than 50, or no pollen grains were found on wasps and syrphid flies, respectively. Lepidopteran insects, though abundant in a few study sites, did not contact anthers or stigmas and had no pollen grains on their bodies. They were solely so-called nectar thieves. Major pollinators of Macrolespedeza are, therefore, apoid bees in northern Japan, as is the case in Korea in the previous study (Yokoyama et al. 2000) or in other papilionaceous legumes (Leppik 1966, Arroyo 1981).

Results of the present observations showed that *Lespedeza bicolor*, *L. cyrtobotrya* and *L. homoloba* had essentially the same fauna of flower visitors. The most frequent visitor was *Bombus* (Apidae: 58.8 % of total visits on the three species; Table 2). The frequencies of other apoid bee genera were relatively low. *Apis* (Apidae) were the second most frequent visitors and represents 9.5 % in the total observations. *Chalicodoma* (Megachilidae) was the third most frequent visitor (9.3 % of total visits) but all were re-

Table 2. Visitors to the Macrolespedeza species observed in the present study

Macrolespedeza species	Study site	year	time (hrs.)	Number of flower visitors													
				Hymenoptera										Diptera	Lepidoptera		
				Apidae		Anthophoridae		Megachilidae			Halictidae	Scolidae	Eumenidae	Hesperiidae	Pieridae	Lycaenidae	Hesperiidae
				Apis	*Bombus*	*Tetralonia*	*Ceratina*	*Megachile*	*Chalicodoma*	*Coelioxys*	*Halictus*						
Lespedeza bicolor	SMN	1997	1	1	17												
	SMN	1998	4.5	8	44						2			1		2	
	MKW	1998	0.5		5		1				1						
	AHK	2003	0.3	2	5			4						1			
	OWN	1999	0.3		8		4										
	MTO	1999	0.6	18	18			1									
	MRK	1997	0.5		7	6	1	6		5						2	
	IZM	1997	3		22		1	3							1		
	IZM	1998	4.5		18												
	FNB	2000	0.3		4												
	TIW	2001	0.3		3												
	GSM	1999	0.3	5	11												
Lespedeza buergeri	ISM	1998	0.3					5	3								
	AOB	1997	5					234	8	8			12		1	20	1
	AOB	1998	2				8	11					1				
	AOB	2000	4					70	2							21	
	THK	1998	4					2	7								1
	THK	2000	2				3	46	3							19	
	TKB	1998	0.5					10					1				
Lespedeza cyrtobotrya	MTO	1999	0.5	6	6												
	OSK	1998	0.3		2		1										19
	IZM	1998	1		6												
	IZM	2000	0.5		3												
	YMD	1997	1	1	32			11		1			1	1		1	2
	SSY	1997	2		26												
	SSY	1998	4.5		18												
	YHK	1999	0.3	5	9												
Lespedeza homoloba	OSK	1998	0.3		10												1
	AOB	1997	3		31	9		6					1				
	AOB	1998	3.5		5			1									
	THK	1998	8	5	2	1		11	50			1	1	2			8
	KWU	1998	0.3		5												

corded on *L. homoloba* in THK. The following two genera, considered to be the main flower visitors of Macrolespedeza in Korea (Yokoyama et al. 2000), were observed only in relatively low frequencies: *Megachile* (Megachilidae, 8.0 %) and *Tetralonia* (Anthophoridae, 3.0 %) (Table 2). The former two genera were observed in all three Macrolespedeza species but *Tetralonia* was not recorded from *L. cyrtobotrya*. This may be due to the relatively high altitude of observation sites of *L. cyrtobotrya* chosen in the present study and preference for high temperature in *Tetralonia* (Yokoyama unpublished).

Comparing proportion of Macrolespedeza pollen in the pollen loads, *Bombus* was, on average, the lowest of the four genera (77.7 % compared with 92.0, 98.6 and 100 % of *Megachile*, *Chalicodoma* and *Tetralonia*, respectively; Table 3). Thus *Bombus* was considered to be a less constant visitor than the other genera. Predominant visitation frequencies observed during the present study (Table 2), however, more than compensated for the low constancy. Therefore, these results suggest that *Bombus* was the most important pollinator in the three species of Macrolespedeza in northern Japan.

The other apoid genera, *Ceratina* (Anthophoridae), *Coelioxys* (Megachilidae), and *Halictus*, were neither frequently sighted nor locally abundant and were considered to be less important than the above genera as pollinators in the three species of Macrolespedeza.

On the other hand, *L. buergeri* showed a quite different faunal composition of flower visitors compared with other species. We observed *Megachile* as the most dominant species among flower visitors to *L. buergeri* (76.1 % of the total visits) but not *Bombus*. Other visitors were observed only in low frequencies, i. e., *Chalicodoma* (5.4 %), *Ceratina* (2.4 %), and *Coelioxys* (2.4 %).

Floral morphology of *Lespedeza bicolor*

Flowers of *Lespedeza bicolor* were 11.1 ± 0.7 mm (average ± SD) long at locality SMN and 10.9 ± 0.8 mm long at IZM. The length of LR was 5.3 ± 0.4 mm at SMN and 4.8 ± 0.4 mm at IZM. Proportion of LR to total flower length was 47 ± 2 % in SMN and 43 ± 3 % in IZM. According to Akiyama (1988), the standard is reflected at about 1/3 from the base in *L. bicolor*. The LR of *L. bi-*

Table 3. Proportion of Macrolespedeza pollen in pollen loads of flower visitors

Lespedeza species	bees	study site	Percent of Macrolespedeza pollen*
L. bicolor	*Bombus*	SMN	69.7 ± 18.4 (19.8–89.7: n = 20)
		MKW	35.0 ± 45.5 (1.5–86.1: n = 3)
		IZM	74.9 ± 14.6 (52.4–96.2: n = 11)
L. buergeri	*Megachile*	AOB	88.0 ± 15.4 (57.0–100: n = 8)
L. cyrtobotrya	*Bombus*	IZM	88.4 (n = 1)
		SSY	85.2 ± 8.9 (58.5–99.8: n = 34)
L. homoloba	*Bombus*	AOB	91.5 ± 14.2 (70.5–100: n = 4)
	Chalicodoma	THK	98.6 ± 2.4 (93.4–100: n = 11)
	Megachile	AOB	88.6 (84.1, 93.2: n = 2)
		THK	99.7 ± 0.7 (98.4–100: n = 5)
	Tetralonia	THK	100 (100, 100: n = 2)

*mean ± SD (min.–max.: n = number of samples).

color was 3–4 mm long calculated from the length of the standard described in Akiyama (1988). The length of LR in our two populations was, therefore, longer than the expected value from the description of Akiyama (1988).

Discussion

The *Bombus*-dominant fauna to Macrolespedeza in northern Japan

From the present observations, we considered that apoid bees were the primary flower visitors acting as pollinators of Macrolespedeza species in northern Japan. Predominant groups were, however, quite different from the previous reports on Macrolespedeza. According to the studies on the flower visitor fauna in Japan from Kanto district and westward, frequent visitors to Macrolespedeza species were *Tetralonia mitsukurii* Cockerell and *Megachile* spp. In the former, species as the only one of the genus observed on Macrolespedeza flowers, is known as highly oligolectic to Macrolespedeza species (Miyamoto 1961a, Iwata 2003). For instance, 90.6 % of the total visits to *Lespedeza cyrtobotrya* were made by the species in 6-year observations at Sasayama, Hyogo (Miyamoto 1962) and 93.0 % in 2-year records at Itabashi, Tokyo (Tanaka 1980). *Tetralonia mitsukurii* also showed high visitation frequency in other Macrolespedeza species, i. e., 56.3 % of the total visits to *Lespedeza formosa* subsp. *velutina* (*L. bicolor* var. *japonica*) at Sasayama, Hyogo (Miyamoto 1962) and 39.8 % to *L. bicolor* at Setaura, Kumamoto (Iwata 1997). *Megachile* spp. are polylectic but predominantly visit flowers of Leguminosae and Compositae (Miyamoto 1961b). The genus was the second most common visitor to *L. cyrtobotrya* at Sasayama, Hyogo (7.9 % of total visits; Miyamoto 1962).

In contrast to those reports, the present results clearly indicate the predominant visitation and the consequent importance of *Bombus* for pollination of Macrolespedeza species except *L. buergeri*. Dominant visitations of *Bombus* to Macrolespedeza were also pointed out at two localities in Korea (Yokoyama et al. 2000). Relative frequency of visitation by *Bombus* spp. were recorded previously in Japan as being 18.8 % of total visits to *Lespedeza formosa* subsp. *velutina* at Sasayama, Hyogo (Miyamoto 1962) and 1.0 % to *L. bicolor* at Setaura, Kumamoto (Iwata 1997), but no records on *L. cyrtobotrya* at Sasayama, Hyogo (Miyamoto 1962). These visitation frequencies were obviously lower than those in the present study except in the case of *L. buergeri*. One of the important causes of the differences should be a gradient of faunal composition of bees in Japan. *Bombus* is dominant in cool temperate to boreal regions of the Northern Hemisphere. Relative abundance of the genus in bee fauna increases northward in Japan. For instance, *Bombus* was reported to be the most common genus in eastern Hokkaido, i. e., 71.5 % of individuals in Kiritappu (Uehira et al. 1979) and 27.8 % in Obihiro (Usui et al. 1976). Relative frequency of the genus was also higher in other regions in northern Japan, i.e., 20.6 % in Mt. Moiwa, Hokkaido (Sakagami et al. 1974), 15.5 % in Hama-Koshimizu, Hokkaido (Fukuda et al. 1973), 20.5 % in Ippitsuyama-Tashiro, Miyagi (Goukon et al. 1992), and 17.3 % in Yutori-numa, Miyagi (Goukon et al. 1991). In contrast to these reports, *Bombus* is a relatively minor element in the bee fauna in Japan from Chubu district and westward, i. e., 7.3 % in Minami, Gifu (Yamauchi et al. 1976a), 3.5 % in Kibi, Wakayama (Matuura et al. 1974), and 7.2 % in Setaura, Kumamoto (Iwata 1997). High visitation frequency of *Bombus* to Macrolespedeza observed here may primarily reflect the regional differences of the bee faunal composition between northern and western Japan.

In some mountainous regions of central to

western Japan, however, the relative frequency of *Bombus* is as high as that in northern Japan. For instance, the *Bombus* frequency in Hida-Hagiwara, Gifu (30.6 %; Yamauchi et al. 1976b) was higher than in most of the previous records in northern Japan. High frequencies of *Bombus* were also reported in Ashi-u, Kyoto (26.7 %; Kato et al 1990), Kibune, Kyoto (23.8 %; Inoue et al. 1990) and Sasayama, Hyogo (15.8 %; Miyamoto 1962). As the Macrolespedeza species were not included in the observations at Hida-Hagiwara, Ashi-u, and Kibune, we cannot compare these records with the present study. On the other hand, the record from Sasayama, included two Macrolespedeza species and the visitation frequency of *Bombus* (18.8 % to *L. formosa* ssp. *velutina* and 0 % to *L. cyrtobotrya*) were still lower than in the present study. There may be two main causes of this difference in the visitation frequency. One is the abundance of *Tetralonia* as a competitor of *Bombus*. As mentioned above, *Tetralonia mitsukurii* is a highly oligolectic species to Macrolespedeza. Appearance of the species also synchronizes with the flowering time of Macrolespedeza (Miyamoto 1961a). In the conditions in which Macrolespedeza species are abundantly visited by *T. mitsukurii*, therefore, most of the flower resources are used by this species. This may force *Bombus* to treat Macrolespedeza flowers as a poor resource and consequently to neglect them. Another cause is the presence of co-flowering plants pollinated mainly by *Bombus*. In northern Japan, Macrolespedeza species excepting *L. buergeri*, bloom earlier than in western Japan. Therefore, our observations were mainly conducted in August to early September. For example, the flowering time of *L. cyrtobotrya* in Sasayama, Hyogo is mainly from September to October (Miyamoto 1962) and widely overlaps that of *Impatiens textori* Miq., one of the important flower resources for the dominant bumblebee, *Bombus diversus*. This may decrease the visitation frequency of *Bombus* to Macrolespedeza species in central to western Japan. Based on our observations in IZM and SSY, *I. textori* blooms from September and there is nearly a month lag behind the flowering time of *L. bicolor* or *L. cyrtobtrya*. As similar situation is also found in the flowering time of *L. homoloba* in AOB and THK although the lags are shorter than IZM and SSY. Furthermore, there is a gap of flower resources for *Bombus* in summer (Yahara 1995, Nakajima unpublished data) and Macrolespedeza species fill up the deficiency of the resources at least in northern Honshu. Therefore the absence or scarceness of *Tetralonia* and co-flowering plants preferred by *Bombus* may form the *Bombus*-dominant flower visitor fauna observed in the present study with respect to Macrolespedeza species.

Absence of *Bombus* on *Lespedeza buergeri*

As opposed to the above cases, we have been unable to find *Bombus* on *L. buergeri* flowers. *Lespedeza buergeri* is the earliest flowering species among Macrolespedeza in northern Japan, usually starting to bloom from late June to early July in Tohoku district. All the species of *Bombus* form colonies and rear workers until the flowering time of *L. buergeri* in Tohoku district. Thus the lack of *Bombus* in the flower visitor fauna of *L. buergeri* is not based on the absence of *Bombus* itself. A preliminary comparison of quantity and sugar concentration of flower nectar between *L. buergeri* and *L. homoloba* showed no obvious differences between the species (nectar volume per flower: 0.26–0.52 μl in *L. buergeri* and 0.21–0.30 μl in *L. homoloba*; sugar concentration of nectar: 19.5–22.3 % in *L. buergeri* and 23.2 % in *L. homoloba*; Nakajima and Yokoyama unpublished data). Therefore, other floral characters such as color and fragrance may be closely related to the absence

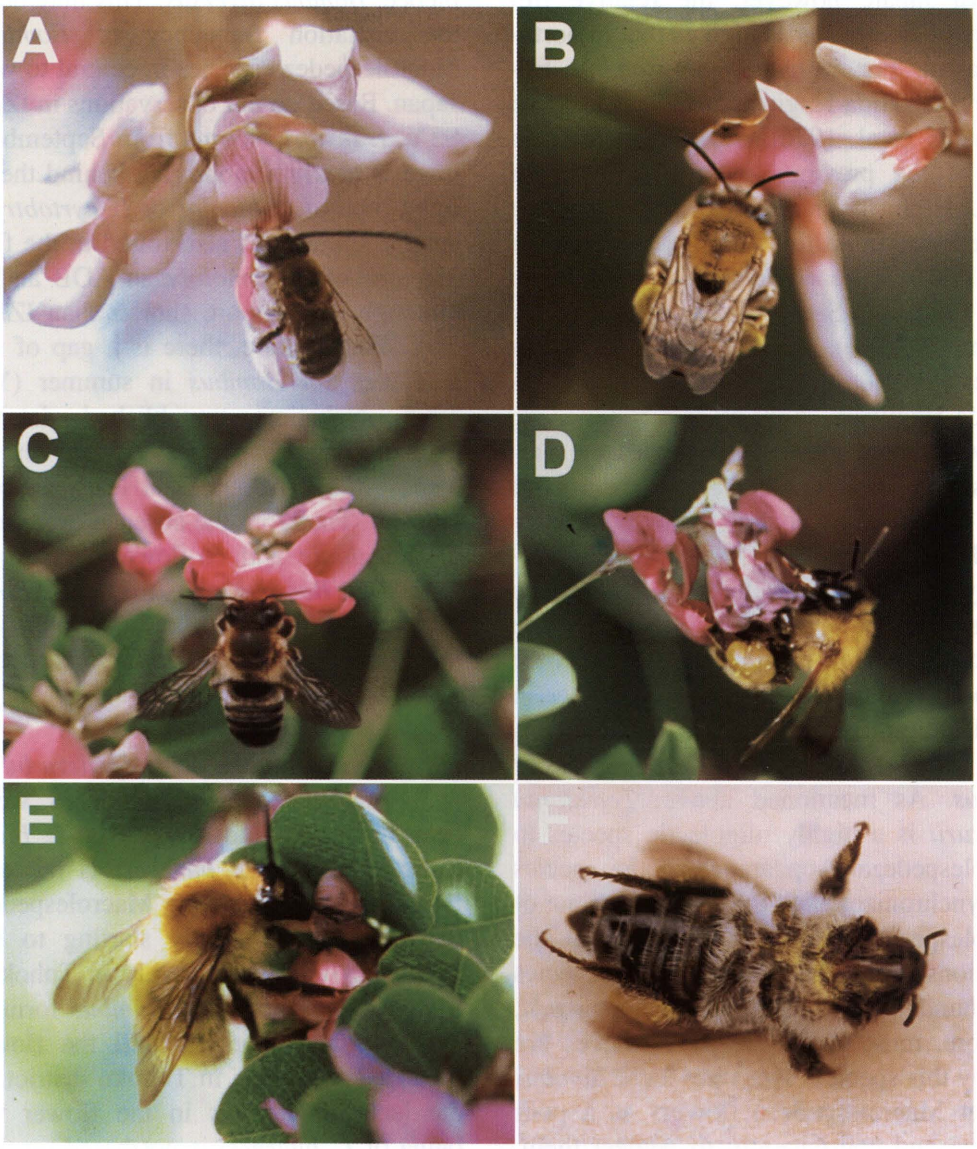

Fig. 2. Apoid bees observed on subgenus Macrolespedeza of *Lespedeza* in northern Japan. A. A male *Tetralonia mitsukurii* visiting to *Lespedeza homoloba*. B. A female *T. mitsukurii* visiting to *L. homoloba*. C. *Megachile* sp. visiting to *L. bicolor*. D. A worker of *Bombus diversus* visiting to *L. bicolor*. E. A worker of *B. honshuensis* visiting to *L. cyrtobtrya*. F. Ventral side of a worker of *B. pseudobaicalensis* after visiting to *L. bicolor*, showing yellow pollen grains of *L. bicolor* spreading on the ventral side of its head and thorax.

of *Bombus* on flowers of *L. buergeri*. Further studies should be conducted to reveal why *Bombus* does not visit *L. buergeri*.

Relationship between flower visitor fauna and floral morphology of *Lespedeza bicolor*

Pollinating insects lead to differentiation of floral traits in a plant species when each regional population of it depends on different pollinating insects (e. g., Cruden 1972, Miller 1981, Robertson and Wyatt 1990, Galen 1996, Johnson 1997, Boyd 2002). In the present study, we noted that relative visitation frequency of *Bombus* on Maclolespedeza species was higher in northern Japan than those of the other regions previously studied. Here we consider the effect of flower visitors on floral character evolution in the case of *L. bicolor* as a model in Macrolespedeza. *Lespedeza bicolor* has a wider distribution than those of any other Macrolespedeza species in Japan (Akiyama 1988). Thus the species is suitable to compare floral characters among regional populations with different flower visitor fauna.

The results of measurements showed that the LR of *L. bicolor* in SMN and IZM was longer than the expected value from the description of Akiyama (1988). Since *Bombus* species have the longest glossae among major flower visitors of Macrolespedeza (Taniguchi 1954), these results seem to suggest the presence of a selective pressure of *Bombus* to flower forms of *L. bicolor* as indicated in Korean *L. melanantha* (Yokoyama et al. 2000). Although extensive surveys throughout of the distribution area of Macrorespedeza are required, we believe that the results of the present study provide an effective working hypothesis to confirm the correlation between flower form and visitor fauna.

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：北日本におけるマメ科ハギ属ヤマハギ亜属の訪花昆虫相

マメ科ハギ属ヤマハギ亜属はメドハギ亜属に比べて大きな花をつけ閉鎖花をもたないことから，昆虫媒であると考えられている．しかし，これまでの訪花昆虫に関する報告は散発的で，送粉に有効な訪花昆虫の確認，ヤマハギ亜属種間における訪花昆虫相の比較などについて基本的な調査がなされてこなかった．

本報では，1997–2003年に北海道および東北地方の各地で行った，ヤマハギ亜属植物4種の訪花昆虫の観察と，種間での訪花昆虫相の比較につい

て報告した．主要な訪花昆虫は4種ともハナバチ類で，キハギ（*Lespedeza buergeri*）を除く3種では特にマルハナバチ属（*Bombus*）の頻度が高かった．訪花昆虫のもつ花粉の分析からは，マルハナバチ類は他のハナバチ類に比べて定花性がやや低いことが示唆された．しかし訪花頻度はそれを補ってあまりあるほど高く，北日本ではマルハナバチ類がキハギを除くヤマハギ亜属の最も重要な送粉昆虫となっていると推測した．一方，キハギではマルハナバチ類は観察されず，ハキリバチ類（*Megachile*）が主要な訪花昆虫であった．キハギの花蜜の量と糖濃度を，マルハナバチ類が訪花するツクシハギ（*L. homoloba*）と比較したが，特に差異は認められなかった．このため，キハギと他の種との間の訪花昆虫相の差異は花色および花香の違いに原因のある可能性がある．

日本産ヤマハギ亜属の中でもっとも広域に分布する種であるヤマハギ（*L. bicolor*）について，花の基部から旗弁が反曲する部分までの長さを計測した．この部分は吸蜜する昆虫の口器の長さに対応すると考えられる．北日本のヤマハギ2集団では，この部分の長さがこれまでの記載に基づく測定値よりも長かった．このことは，ヤマハギ亜属で観察されたハナバチ類の中では最も中舌の長いマルハナバチ属がこの2集団で最も訪花頻度の高いことと関連があると考えられる．

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